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List of Stars in the B. A. Catalogue already observed, in which the Right Ascension differs by more than One Second in Time from that Catalogue.

B.A.C.	Excess of Observed Mean Place above B.A.C. s	No. of Obs.
1826	+ 1·16	6
1907	− 5·18	7
2070	− 1·06	2
2488	+ 1·30	3
3086	− 1·55	2
3233	−60·71	2
3627	+ 1·46	5
4199	+ 1·63	5
4652	+28·97	5
4682	+ 1·21	5
4723	− 1·43	5
4776	− 1·34	5
4920	− 1·34	4
5091	− 1·02	4
5527	+ 1·87	2

Micrometrical Measurements of Double Stars, made at Ormskirk between 1834·0 *and* 1839·4. By W. R. Dawes.

"The observations which I have now the honour of presenting to the Society were made partly with the 5-foot equatoreally-mounted achromatic telescope employed in procuring the results published in the eighth volume of the *Memoirs*, and partly with a Newtonian reflector having a focus of about seven feet and an aperture of six and a quarter inches. The large mirror and the small plane mirror of this telescope were presented to me by Sir John Herschel during my visit to him at Slough in the autumn of 1833, previous to his departure for the Cape of Good Hope. These metals were mounted for me by Mr. Dollond, so as to be applied to the polar axis of my 5-foot achromatic, and to supply the place of the counterpoise to the telescope and declination-circle in that mounting. The motion in polar distance was produced by means of two brass circles, about two feet in diameter, one of which was firmly attached to the polar axis, and the other to the tube of the reflector; the circles being united at their centres, and fixable by a clamp at any required polar distance. A small setting-circle with a level was attached to the outer side of the tube, whose vernier read to one minute. This mounting was found to be sufficiently steady, in tolerably calm weather, to allow of satisfactory measures with the micrometer; and, as far as I know, it was the *first* successful attempt to give to a Newtonian reflector a universal equatoreal motion suitable to the delicate micrometrical measurements of double stars.

"The large metal was cast and originally figured by Sir William Herschel; but the surface having become greatly tarnished, it was repolished by Sir John, shortly before he presented it to me. Its figure was sufficiently good to give a neat round disk to a star; and from its *larger aperture*, its *separating* power

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considerably exceeded that of the 5-foot achromatic: so that on tolerably bright and very close double stars, such as γ *Virginis* at that period, and λ *Ophiuchi* (then much closer than at present), its superiority was unquestionable. Unfortunately, it soon lost so large a portion of its lustre that its illuminating power became inferior to that of the 5-foot refractor. It was also much less certain and uniform in its action, though a great variety of expedients were resorted to in hopes of overcoming this annoying defect; some of which were productive of advantage, though not to the extent of rendering it as uniform in its action as the refractor. By Sir John Herschel's recommendation it was bedded in its box on folds of flannel, the edge of the metal also resting on the same soft and elastic substance. The effect of friction on its edge being, however, still too obvious, I substituted for the flannel a piece of strong tape, supporting the metal as in a sling, and permitting it without obstruction to take an equal bearing against the flannel at the back. This I found to be a decided improvement; and Mr. Lassell, having recently adopted a similar plan in the mounting of his 9-inch and 24-inch metals, also bears testimony to its great utility. As, however, a telescope requires for its perfect action that the state of the air should be good in a degree proportioned to the area of the object-glass or metal, vision was usually, on most objects, best in the refractor; and even in the finest states of the atmosphere the reflector did not always answer the reasonable expectations of the observer; and much precious starlight was frequently lost in vain attempts either to discover or remove the cause of its distress. This circumstance, combined with its rapid loss of lustre, caused the reflector to be but little employed during the latter part of the period embraced by these observations.

"In the measurement of very minute stars, the achromatic concave lens, mentioned in my former communication, has been very generally employed. As the construction and use of this valuable appendage has not, I believe, been described in any paper presented to this Society, it may be proper to refer to it here more particularly. The lens is fully described in a paper by Mr. Dollond, which was read before the Royal Society in February 1834; into which paper were introduced a letter from myself to Mr. Dollond, stating the advantages of its application to the micrometer, and also a letter to Mr. Dollond from Professor Barlow, the *inventor* of the lens, detailing the formulæ according to which it was constructed. Mr. Dollond says in the paper alluded to, 'I do not wish to take credit to myself for anything like an invention, but merely for the application of the lens to the micrometer, as I am fully convinced that a concave lens, either simple or achromatic, was never so applied before.' In referring to this achromatic concave lens, in the notes appended to these observations, I have therefore termed it '*the* BARLOW *lens*,' by which name justice is done to its inventor. In Mr. Dollond's valuable application of it to micrometrical purposes, it is introduced, by the tube in which it is mounted, into the main tube of the telescope, so as to intercept

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the rays transmitted by the object-glass before they come to focus. The focal image is thrown a few inches further from the object-glass than it otherwise would be, and it is proportionably *enlarged.* By a variation of the distance between the object-glass and the Barlow lens, the degree of enlargement is altered; and thus that amplification of the image can be fixed upon which best suits the purpose of the observer. The lens Mr. Dollond constructed for me was mounted in a piece of tube, of such a length that when screwed into the telescope it rather more than doubled the diameter of the focal image: and this proportion appeared to be generally the most useful.

" The advantages attending the use of the Barlow-lens may be *comparatively* summed up as follows:—

" 1. The diameter of the micrometer-threads subtends only about half the angle: small stars are, therefore, neither obliterated nor distorted by them.

" 2. The moveable parallel threads are *both as nearly in focus*, with double the magnifying power. This is a most important matter in the measurement of distance. As the parallel spider's lines must pass each other freely, they must move in different planes, and at different distances from the eye-piece. Consequently, when high powers are produced in the ordinary way on a telescope of the usual proportions (the power being, for instance, more than five or six times the focal length, expressed in inches), there is an obvious indistinctness in one of the threads when the other is accurately in focus. This defect is nearly got rid of by the use of the Barlow-lens.

" 3. The value of the micrometer divisions with the Barlow-lens is only about half of its amount without it; permitting a proportionably fine motion in the measurement of distance.

" 4. With any given magnifying power, the threads are distinct to a much greater distance from the centre of the field; the eye-piece producing the power having double the focal length.

" 5. The eye-pieces of greater focal length are much more easily cleaned than those of less; of great importance in high powers especially.

" 6. The small reflecting *prism* interposed between the eye-piece and the eye can be advantageously employed with double the magnifying power on the telescope. This extension of its utility is of great value.

" As a set-off against the important advantages above enumerated, it must be acknowledged that the application of the lens increases the length of the telescope by a few inches, and also that it is requisite to determine the value of the micrometer-screw with the lens attached to the telescope, as well as without it. Neither of these objections, however, is of much practical importance. One of more weight is the greater illumination of the field, which is requisite to render the very fine spider's lines sufficiently visible. For this, the most efficient remedy (in addition to the *deep red* illumination) is an increase of magnifying power. By this means the apparent diameter of the threads is augmented *in proportion to the power,*

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while the brightness of the field is *diminished* in the *duplicate ratio* of the increase of power. It is important to notice that the brilliancy or vividness of a *fixed star* is *not* diminished in the same proportion, though it is usually assumed to be so. To an object of sensible diameter, as a planet, such reasoning is applicable, but not to a fixed star, the apparent diameter of whose telescopic disk is *not* increased *in proportion to the power employed.*

"The spider's lines, when thus attenuated by the use of the Barlow-lens, are too fine for use in observing angles of position; my own eye, at least, is dissatisfied with them, as not possessing sufficient substance for the judgment to lean upon. I, therefore, had two pretty thick parallel metallic wires fixed into the micrometer-plate, which formerly held a single spider's line at right angles to the moveable parallel threads, and intended for measures of position. The diameter of each wire subtended an angle of about 4″, and the inner edges were placed about 7″ or 8″ apart. Their visibility with feeble illumination of the field extended the power of the telescope, in measuring angles of position, to stars of fully one magnitude lower. Their perfect parallelism was proved by stars rolling along the inner edge of both with the same setting of the position-circle.

"In the *Introduction* to my former double-star observations, I adverted to the importance of placing the stars parallel to a principal section of the eye; so that they should appear in the telescope nearly vertical or nearly horizontal. Further experience has even more fully convinced me of the necessity for this. When the obliquity of the star's position is not more than 20° or 30°, a corresponding inclination of the observer's head may answer the purpose without introducing an inconvenient posture. When, however, the angle of position lies between 30° and 60° from the meridian, the use of the reflecting prism attached to the eye-piece renders it easy to adapt the apparent position of the stars to the observer's convenience. By the help of this valuable little appendage, many of the stars in the following catalogue were observed both in an apparently vertical and horizontal position, in order, as much as possible, to destroy all bias of the judgment."

We have selected from Mr. Dawes' paper some notices of remarkable stars.

γ Ceti. Σ 299. Mr. Dawes gives the angles of positions by several observers, and considers that the agreement between the angles of the same observer, and the discrepancies between different observers, seem to show somewhat of a *personal equation.* The observations make the binary character of the star probable, but do not prove it to be so indubitably.

Castor. Σ 1110. "My observations of this star since 1833 do not confirm the orbit predicted by Sir John Herschel (*Mem. Ast. Soc.* vol. v. p. 203). The distance is still increasing, and is now fully 5″."

γ Virginis. Σ 1670. "The angle I obtained in 1834 being the result of eight nights' observation is probably entitled to some consideration, although the distance was only about 0″·9."

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44 *Boötis.* Σ 1909. "The observations of this star show a continued augmentation of the distance, with a very slight increase in the angle of position."

ξ *Scorpii* (= ξ *Libræ* = 51 *Libræ*). Σ 1998. "The variation of the angle of position of these stars in a direct sense is supported by the observations given in the following catalogue. Combined with my observations for 1833 contained in my previous paper, we have,

1833·39	P = 6°·20	D = 1″·15	by 1 night's obs.
1834·50	7·12	1·166	— 4 — —
1836·49	9·53	...	— 1 — —

In the *Phil. Trans.* for 1785, the position is given by Herschel I. as 82° 2′ *north following*, or 7° 58′ in the notation now used. As, however, the stars are almost exactly equal, it seems highly probable that, to compare it with the more modern observations, the position should be increased by 180°. Instead, therefore, of a *whole* revolution having been performed since 1782, it is most likely that only about 197°·5 have been passed over. The apparent distance seems to have varied but little. The angle of position at the present time (1850) is about 31°."

Cephei 83. Σ 2751. "A diminution of distance in these stars is probable, while the variation in position, if any, is so small as to be completely masked by the errors of observation."

Pegasi 29. Σ 2804. "This object was supposed by Sir John Herschel to be in rather rapid rotation, from a comparison of his own measures with each other, and with those taken by Sir James South in 1826. It is remarkable that Struve arrived at the same conclusion from comparing together his own observations during six years, which show a pretty regular increase of nearly 5° in that time. The measures which I have obtained, however, do not bear out so rapid a motion, even if there be any; and Struve's re-examination of the star led him to reject the supposition of change. My observations at two different epochs are as follows:—

1832·87	P = 314°·17	D = 3″·12	by 1 night's obs.
1835·44	317°·00	3″·18	by 3 — —

"Notwithstanding the trouble which this star has already given, it is desirable that it should be still further examined, as it may be questioned whether its real nature is even yet determined."

ζ *Aquarii.* Σ 2909. "The retrograde motion of these stars is distinctly shown by the observations here recorded.

"A diminution of distance may be suspected, though it must be acknowledged that my earlier measures of distance were generally too large."

Σ 3061. "The change which Sir John Herschel suspected was going on in this star is by no means supported by my observations.

"It is worthy of remark that in this case, as in most others in which extraordinary changes of angle have been deduced from erroneous observations, the position of the stars is very *oblique* to the

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meridian; and it is probable that, in the earlier measurements, no peculiar precautions were adopted on that account."

The catalogue then follows, and consists of 627 entries (many of these relate to the same star), containing the name of the star, Struve's number, the approximate right ascension and north polar distance for 1840, the angle of position and distance, with the number of observations, the weight of the result, and the magnifying powers employed. Finally, are set down the magnitudes of the component stars and the epoch at which the measures were made.

On the Longitude and Latitude of the Observatory, George Town College, near Washington, and the Situation of some Leading Points in that City. By Mr. Curley.

"The latitude of our Observatory is deduced from 7 observations of *Polaris* above and below pole, 7 observations of *α Ursæ Majoris* above and below pole, 7 observations of *λ Ursæ Minoris*, using the *Nautical Almanac* declination, and 180 observations of other stars. The mean of these accordant observations gives the latitude of George-Town College Observatory 38° 54′ 26″ North.

"The instrument with which the observations were made is a meridian transit circle by Simms, with a divided circle of 45 inches diameter, read off by four microscopes. The telescope is of 5 feet focus and 4 inches aperture. The nadir point was found by viewing the wires reflected from a surface of mercury.

"The longitude from Greenwich is deduced from four corresponding lunar transits made at Greenwich and George Town, with all the seven wires. The Astronomer Royal very kindly sent the observations immediately on request. There were more corresponding observations, but as some of the wires were wanting, and as the mean of seven wires from imperfect transits generally differs from the mean of seven wires observed, the perfect observations alone were employed. The transit instrument is by Ertel of Munich. The object-glass has a focal length of 6 feet, and the aperture is of 4·6 inches. The clock is a good one, by Molyneux of London.

"The computation was performed nearly in the manner recommended by Mr. Baily. Having got a good approximation to the longitude of George Town, the increase of the moon's right ascension between the two meridians was divided by the moon's hourly motion computed for the mean of the Greenwich times of observation. The result is, that the George-Town College Observatory is $5^h\ 8^m\ 18^s{\cdot}2$ West of Greenwich."

By a base of 957 feet, measured along the aqueduct leading the Chesapeak and Ohio Canal across the Potowmac, and a Munich universal instrument, which reads off horizontal angles to 10″, Mr. Curley found the distance between the National Observatory and the George-Town Observatory to be 8764·4 feet.